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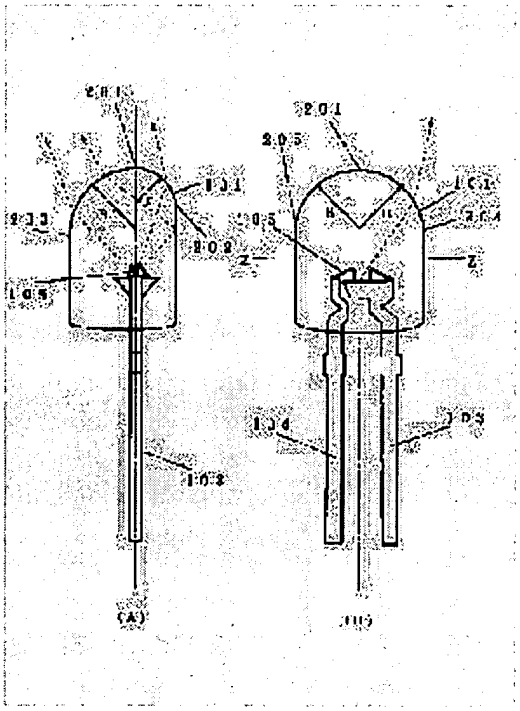
(54) LIGHT EMITTING DIODE, AND SIGNALING

(57)Abstract:

PROBLEM TO BE SOLVED: To make it possible to reduce light at a given angle from a light emission observing side without a bad influence and increase the luminance of light at a different angel, as an optical signal with respect to a light emitting element sealed with a transparent lens-shaped molding member.

SOLUTION: A light emitting diode includes at least two lead terminals 103 and 104, a light emitting element connected electrically, and a transparent molding member 101 molding the light emitting element. The transparent molding member 101 has a top 201 as a projected optical lens. In this case, first to fourth radii of curvature including an optical axis crossing the tip 201 of the transparent molding member 101 having a relation such that the first radius of curvature from the tip 201 to an end 202 is larger than the third radius of curvature from the tip 201 to an end 204, the fourth radius of curvature from the tip 201 to an end 205 is equal to or larger than the second radius of curvature from the tip 201 to an end 203.



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CLAIMS

[Claim(s)]
[Claim 1] The light emitting device electrically connected with at least two lead terminals (103) (104) (102) The translucency mold member from which this light emitting device (102) is closed, and a tip (201) serves as a convex optical lens (101) The 1st radius of curvature from the tip (201) which constitutes the cross section of the translucency mold member (101) which is the light emitting diode equipped with the above, and includes the optical axis passing through said tip (201) to an edge (202), and the 2nd radius of curvature from a tip (201) to the other-end section (203), The 3rd radius of curvature from the tip (201) which constitutes said cross section including an optical axis and the cross section which makes a perpendicular to an edge (204), and the 4th radius of curvature from a tip (201) to the other-end section (205) are characterized by filling the following relation, respectively. Magnitude of the magnitude < 3rd radius of curvature of the 1st radius of curvature, and magnitude of the magnitude <= 2nd radius of curvature of the 4th radius of curvature [Claim 2] The magnitude of the 3rd radius of curvature and the magnitude of the 4th radius of curvature are in abbreviation etc. by carrying out, and it is light emitting diode according to claim 1.
[Claim 3] Light emitting diode according to claim 1 the cross section which sees from the luminescence observation side side on an optical axis, and constitutes the 3rd and 4th radius of curvatures, and whose between said lead terminals (103) and orientation of (104) are abbreviation parallel.
[Claim 4] Said lead terminal (103) is light emitting diode according to claim 1 which has the light emitting device (102) which looked at from the luminescence observation side side on an optical axis in this cup (401) while having the cup (410) which reflects the light from a light emitting device (102), and the radiant power output by the side of the 1st radius of curvature arranged highly rather than the 2nd radius-of-curvature [of a translucency mold member (101)], 3rd radius-of-curvature, and 4th radius-of-curvature side.
[Claim 5] The light emitting device electrically connected with at least two lead terminals The translucency mold member from which this light emitting device is closed and a tip serves as a convex optical lens The 1st radius of curvature from the tip which constitutes the cross section of the translucency mold member which is the signal equipped with the above and includes the optical axis with which said light emitting diode passes along a tip to an edge, and the 2nd radius of curvature from a tip to the other-end section, The 3rd radius of curvature from the tip which constitutes said cross section including an optical axis and the cross section which makes a perpendicular to an edge, and the 4th radius of curvature from a tip to the other-end section, respectively The magnitude of the magnitude < 3rd radius of curvature of the 1st radius of curvature, While filling the relation of the magnitude of the magnitude <= 2nd radius of curvature of the 4th radius of curvature, it is characterized by having arranged each light emitting diode in the same direction.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the light emitting diode which can be made to emit the light of another side to high brightness, seeing the object for signals etc. from a luminescence observation side side, it controlling one light, and lessening effect of the control especially, with respect to the light emitting diode which closed the light emitting device in the lens-like mold member of translucency.
[0002]
[Description of the Prior Art] The light emitting diode which can emit light in the super-high brightness by which red, yellow, blue, and a bluish green color amount to 1000 or more mcds was developed today. Since light emitting diode is a semi-conductor light emitting device, strongly, it can be stabilized for a long period of time, and can emit light to vibration etc. Moreover, there is also the advantage in which power consumption is low. Furthermore, as for light emitting diode, monochromatic peak wavelength emits light from a semiconductor device. Therefore, in order to make only each luminescent color express like a white LGT, it is not necessary to use a color filter. In order to use effectively the light emitted isotropic further again, it is not necessary to use a large-sized reflective mirror. Therefore, when light emitting diode is used for a signal, the false lighting phenomenon which reflects by the large-sized reflective mirror by which outpatient department light carried out incidence and was prepared in the interior of a signal at the posterior part of a white LGT, and is emitted out of a signal through a color filter is not produced. Therefore, light emitting diode is used as the ideal light source used for a signal.
[0003] In order to use light emitting diode for signals efficiently more, as for the light source for signals with a reflective mirror etc., it is desirable to differ and for the light emitting diode per piece to have desired directional characteristics. As an orientation property of the light emitting diode used for signals, transverse-plane altitude does not need to emit light upward highly. On the other hand, in a longitudinal direction and slanting down one, it may be necessary to check by looking by the location. Therefore, each light emitting diode needs to have the above-mentioned orientation property, respectively.
[0004] On the other hand, the light emitting diode used for a display etc. may also be asked for the luminescence property near the light emitting diode for signals. As an example of light emitting diode which strengthened the light of the specific direction, JP,5-121785,A, JP,5-275752,A, JP,8-162673,A, etc. are mentioned.
[0005] As shown in drawing 7 (A), (B), and (C), in JP,5-275752,A At least two lead terminals (703) (704), The light emitting device by which bonding was carried out with the wire (705) in the lead terminal (704) of another side while die bonding was carried out at the tip of one lead terminal (703) (702), The light emitting diode which consists of the mold member with a lens made of synthetic resin which packs the part at the tip of both lead terminals (703) (704) is indicated. Especially, it has considered as the light emitting diode formed so that it might extend to a lens [in / for a flat surface (711) parallel to the axis in the mold section / the mold section] (701) in a part of peripheral face in the mold section of light emitting diode.

[0006] By considering as such a lens configuration, the light by which outgoing radiation is carried out toward the flat surface (711) established in the peripheral face of the mold section among the light by which outgoing radiation is carried out from a light emitting device is reflected according to a flat surface (711). Outgoing radiation of the reflected light is carried out from a direction opposite to a flat surface (711). The quantity of light which reaches people's eyes by the outgoing radiation quantity of light by which outgoing radiation is carried out from a direction opposite to a flat surface (711) can be up(ed). Therefore, as light emitting diode, what has the so small quantity of light can be used, and it is indicated that power consumption is reducible.
[0007]
[Problem(s) to be Solved by the Invention] However, the light emitting diode formed in this way not only cannot fulfill the above-mentioned property for signals, but may not necessarily do above-mentioned effectiveness so. Although condensed in accordance with the configuration of a mold member, if the light emitted from the LED chip which is a light emitting device makes the whole surface of the mold member of a shell mold form in the shape of a flat surface (711), the light which emitted light from the light emitting device (702) will carry out total reflection of it. Total reflection may be carried out [in / as a design united with the curvature in transverse plane of a lens among the light by which total reflection was carried out / a lens transverse plane]. Therefore, the light from the light emitting device (702) emitted toward the direction of a flat surface repeats reflection within a mold member along a lens (701) curved surface that it is hard to be emitted from the transverse plane of a mold member, and may be emitted from a rear-face side (namely, non-emitting light observation side). When the light from a light emitting device is emitted into air, using an epoxy resin as a mold member, the light which carried out total reflection also becomes below a critical angle from the difference in a refractive index, and it is not emitted outside.
[0008] A shell configuration cannot but become strong if you are going to make it emit the light from the light emitting device by which total reflection was carried out at the flat surface (711) to a luminescence observation side side using such a mold member. Therefore, collecting power has the problem that light with width of face (0 degree of the half-value width of about 15 degrees - 20 degrees of a longitudinal direction, the down half-value width of about 15 degrees - 20 degrees, and above half-value width is sufficient.) wide to some extent cannot be strongly obtained to right and left, such as an object for signals, or down. Moreover, it has the problem that light is not necessarily emitted depending on a light emitting device as a lens design. Therefore, these people are about the luminescence property as the request which solved the above-mentioned trouble and was suitable for the use for signals etc. to offer the efficient light emitting diode which can emit light.
[0009]
[Means for Solving the Problem] This invention is light emitting diode which has the light emitting device (102) electrically connected with at least two lead terminals (103) (104), and the translucency mold member (101) from which this light emitting device (102) is closed, and a tip (201) serves as a convex optical lens. The 1st radius of curvature from the tip (201) which constitutes the cross section of a translucency mold member (101) including the optical axis which passes along a tip (201) especially to an edge (202), and the 2nd radius of curvature from a tip (201) to the other-end section (203), The 3rd radius of curvature from the tip (201) which constitutes a cross section including an optical axis and the cross section which makes a perpendicular to an edge (204), and the 4th radius of curvature from a tip (201) to the other-end section (205) It is the light emitting diode which fills the relation between the magnitude of the magnitude < 3rd radius of curvature of the 1st radius of curvature, and the magnitude of the magnitude <= 2nd radius of curvature of the 4th radius of curvature.
[0010] While reducing the unnecessary upper quantity of light by this, in a longitudinal direction and down, it can consider as the high brightness light emitting diode which can emit light on a wide-field-of-view square. Especially, the incidence of the outpatient department light 1st from [with small radius of curvature] radius of curvature (above) can be prevented, and contrast can be raised. Moreover, it can consider [the 3rd and 4th radius of curvature with large radius of curvature (right and left), or / 2nd] as the large luminescence property of an angle of visibility from radius of curvature (below).

[0011] That is, as for the light which went in the direction where radius of curvature is small from the light emitting device, an angle of visibility can raise whenever [axial Uemitsu] narrowly. Moreover, light which went in the direction where radius of curvature is large from the light emitting device can be made more into the large luminescence property of an angle of visibility.
[0012] The magnitude of the 3rd radius of curvature and the magnitude of the 4th radius of curvature are in abbreviation etc. by carrying out, and the light emitting diode of this invention according to claim 2 is light emitting diode. The cross section which looks at the light emitting diode of this invention which directional characteristics can use [a longitudinal direction] as equal light emitting diode widely by this at homogeneity according to claim 3 from the luminescence observation side side on an optical axis, and constitutes the 3rd and 4th radius of curvatures, and between lead terminals (103) and the orientation of (104) are abbreviation parallel. Thereby, the crack of a mold member etc. can consider as very little reliable light emitting diode.
[0013] The light emitting diode of this invention according to claim 4 is seen from the luminescence observation side side on an optical axis in a cup (401) while it has the cup (410) from which a lead terminal (103) reflects the light from a light emitting device (102), and it has the light emitting device (102) considered as arrangement with the radiant power output higher than a 2nd radius-of-curvature [of a translucency mold member (101)], 3rd radius-of-curvature, and 4th radius-of-curvature side by the side of the 1st radius of curvature. Thereby, the light from a light emitting device can be used more effectively, and the luminescence property as a request can be acquired.
[0014] The signal of this invention according to claim 5 has carried out two or more arrangement of the light emitting diode which has the light emitting device electrically connected with at least two lead terminals, and the translucency mold member from which this light emitting device is closed and a tip serves as a convex optical lens. The 1st radius of curvature from the tip which constitutes the cross section of a translucency mold member including the optical axis with which especially light emitting diode passes along a tip to an edge, and the 2nd radius of curvature from a tip to the other-end section, The 3rd radius of curvature from the tip which constitutes said cross section including an optical axis and the cross section which makes a perpendicular to an edge, and the 4th radius of curvature from a tip to the other-end section, respectively The magnitude of the magnitude < 3rd radius of curvature of the 1st radius of curvature, While filling the relation of the magnitude of the magnitude <= 2nd radius of curvature of the 4th radius of curvature, each light emitting diode is arranged in the same direction. While reducing the unnecessary upper quantity of light by this, in a longitudinal direction and down, it can consider as the high luminance-signal machine which can emit light on a wide-field-of-view square.
[0015]
[Embodiment of the Invention] As a result of various experiments, this invention person making one angle of beam spread control, and raising main altitude, by making a mold member into a specific configuration, he finds out that other angles of beam spread are controllable, and came to accomplish this invention.
[0016] That is, the luminescence property which became independent about the configuration of a mold member, respectively by having at least two or more kinds of different radius of curvatures, such as above, a longitudinal direction, and down, can be shown. Large luminescence of half-value width can be obtained from an end face with large radius of curvature, using the light from [with small radius of curvature] an end face for the improvement in transverse-plane brightness. Especially as a mold member of the light emitting diode for signals The 1st radius of curvature which serves as the upper part of a translucency mold member from an optical axis, the 3rd radius of curvature used as a longitudinal direction, the 2nd radius of curvature used as the 4th radius of curvature and a lower part -- at least -- curvature < 3rd curvature = -- the angle of visibility of a longitudinal direction or a lower part can be made large, making the light to the upper part contribute to transverse-plane luminescence by considering as the relation between the 4th curvature and the 2nd curvature. [of ** a 1st]
[0017] Hereafter, an example of this invention is shown in drawing 5 . The LED chip with which the red which has an AlGaInP layer as a luminous layer on a GaP substrate can emit light was used for drawing 5 as a light emitting device (502). The electrode of a pair is formed on both sides of semi-conductor

junction, and the LED chip constitutes the light emitting device (502) in which isotropic luminescence is possible. Next, on a mounting lead (503), Ag paste is used and die bonding of the LED chip is carried out. On the other hand, wire bonding was carried out to the inner lead (504) using the gold streak (505), and it was made to connect electrically, respectively. The LED chip (502) arranged on a mounting lead (503) was covered with the insert molding of an epoxy resin, and the mold member (501) was made to form.

[0018] The 1st radius of curvature from the tip which constitutes the cross section of a translucency mold member (501) including the optical axis with which the formed light emitting diode passes along a tip to an edge, and the 1st radius of curvature and the 2nd radius of curvature from a symmetrical tip to the other-end section, The 3rd radius of curvature from the tip which constitutes said cross section including an optical axis and the cross section which makes a perpendicular to an edge, and the 3rd radius of curvature and the 4th radius of curvature from a symmetrical tip to the other-end section Magnitude of the magnitude < 3rd radius of curvature of the radius of curvature which is the 1st, respectively = it has considered as the magnitude of the magnitude <= 2nd radius of curvature of the 4th radius of curvature. Moreover, the direction (504) and the cross section which constitutes the 1st and 2nd radius of curvatures of a mold member (501) are arranged to abbreviation parallel between lead terminals (503). The conductive wire (505) to which an LED chip (502) and an inner lead (504) are connected so that light can be efficiently taken out from a 1st, 3rd, and 4th radius-of-curvatures side is arranged to the 2nd radius-of-curvature side.

[0019] Thereby, it can consider as the suitable light emitting diode for a transverse plane, right and left, and the object for signals with down high brightness with the large angle of visibility by the side of the 3rd, 4th, and 2nd radius of curvatures (right and left and down) that there is little luminescence by the side of the 1st radius of curvature (above). Hereafter, the configuration of this invention is explained in full detail.

[0020] (Mold members 101 and 501) A mold member (101) (501) emits light towards a request of the light from a light emitting device (102) (502) while protecting the wire used as some of light emitting devices (102) (502), lead terminals (103) (104) (503) (504), and an electrical installation member (105) (505) etc. from the exterior. The mold member (101) (501) of this invention makes the light emitting diode with which the curved-surface radii from a convex abbreviation tip to an edge differ, respectively constitute including a convex lens configuration. Therefore, by the part where radius of curvature is small, the light from a light emitting device (102) (502) can be condensed on an optical axis, whenever [axial Uemitsu] can be raised, and efficient-ization can be attained.

[0021] Furthermore, the light emitting diode for signals etc. is arranged to above [to which incidence of the sunlight etc. is carried out in the curved surface where radius of curvature is small]. Thereby, a light a longitudinal direction with larger radius of curvature than above and down can be made to be extended more widely, raising the transverse-plane luminous intensity on an optical axis. Moreover, reflection of outpatient department light, such as sunlight which carries out incidence from the direction where radius of curvature is small, can be decreased.

[0022] A mold member (101) (501) can also be made to contain various additives, such as a coloring agent, optical stabilization material, a dispersing agent, and a fluorescent substance. The duty of the filter which cuts the wavelength besides a request can also be given by making a mold member (101) (501) contain a coloring agent. Moreover, by making a dispersing agent contain, the directivity from a light emitting device (102) (502) can be made to be able to ease, and an angle of visibility can be increased. Furthermore, color mixture light can also be made to emit light by making a fluorescent substance contain. It can consider as the light emitting diode with which color mixture light can emit light in high brightness with the combination of the light emitting device which consists of a nitride semi-conductor which can emit light with comparatively large energy especially, and the fluorescent substance which is excited by the light emitted from a light emitting device, and emits light in long wavelength light rather than it. When the light from a light emitting device and the light from a fluorescent substance have a complementary color relation mutually, luminescence becomes possible about the white light. The yttrium aluminum garnet system fluorescent substance and perylene system

derivative which were activated with the cerium as such a fluorescent substance are mentioned suitably.
[0023] As a concrete ingredient of a mold member (101) (501), translucency resin, glass, etc. excellent in the weatherability of an epoxy resin, a urea resin, imide resin, etc. are used suitably. Moreover, as a dispersing agent, barium titanate, titanium oxide, an aluminum oxide, oxidation silicon, etc. are used suitably. Such a mold member (101) (501) can be formed comparatively easily by insert molding, the potting method, etc.
[0024] In addition, with the radius of curvature of this invention, not only the radius of curvature in the spherical surface but the approximated thing in the aspheric surfaces, such as **** and an ellipse, as long as the effectiveness of this invention is substantially done so is included. Therefore, in the case of the aspheric surfaces, such as an ellipse, it can judge by the size of the magnitude of a minor axis in false. Similarly, the lens scale factor seen from the luminescence observation side side on an optical axis can also compare the approximated curvature. Moreover, in the combination of the spherical surface and the aspheric surface, it can also judge by the size of radius of curvature and a minor axis.
[0025] The scale factor of the lens side containing the 1st (it approximated) curvature specifically The 1st lens scale factor, (It approximated) The scale factor of the lens side which contains the 3rd lens scale factor and the 4th (it approximated) curvature for the scale factor of the lens side which contains the 2nd lens scale factor and the 3rd (it approximated) curvature for the scale factor of the lens side containing the 2nd curvature is divided with the magnitude of the 4th lens scale factor, respectively.
[0026] the partial lens scale factor of a mold member (101) (501) -- respectively -- lens scale-factor [of ** a 2nd] <= -- the 3rd lens scale factor and the 4th lens scale factor -- < -- the relation (lens scale-factor [of ** a 2nd] <= -- lens scale-factor [of ** a 3rd] = -- the 4th lens scale factor -- < -- the relation of the 1st lens scale factor) of the 1st lens scale factor will be filled. In this case, if light emitting diode is observed from the luminescence observation side side on an optical axis, it will be observed by the lens effectiveness of the specific mold configuration (101) (501) of this invention as the light emitting device (102) and lead terminal (103) like drawing 1 , and (104) have been arranged distorted.
[0027] (Light emitting devices 102 and 502) The light emitting device (102) (502) used for this invention is a semi-conductor light emitting device which can emit light in response to supply of power. such a semi-conductor light emitting device -- a liquid phase grown method and MOCVD -- the structure which carried out the laminating of the various semiconductor materials on the substrate by law etc. is mentioned. As a concrete ingredient used for the luminous layer of a semi-conductor light emitting device, GaAs, GaP, GaAlAs, GaAsP, AlGaInP, GaN, InN and AlN, InGaN, InGaAlN, etc. are mentioned suitably. As structure of a light emitting device (102) (502), terrorism structure etc. is mentioned to the gay junction, the heterojunction, and double which have MIS junction, pn junction, and PIN junction. Moreover, it can consider as the single quantum well structure and multiplex quantum well structure where the quantum effectiveness produces a luminous layer. Luminescence wavelength can be variously chosen from an ultraviolet region to an infrared region by whenever [ingredient or its mixed-crystal]. [of a semi-conductor layer]
[0028] As a concrete example, a nitride system compound semiconductor light emitting device is shown. A nitride system compound semiconductor light emitting device forms buffer layers, such as GaN, AlN, and GaAlN, on a sapphire substrate, and makes the gallium nitride semi-conductor which has pn junction form on it. A gallium nitride system semi-conductor shows n mold conductivity in the condition of not doping an impurity. In addition, when making n mold gallium nitride semi-conductor of a request, such as raising luminous efficiency, form, it is desirable to introduce Si, germanium, Se, Te, C, etc. suitably as an n mold dopant.
[0029] On the other hand, when making p mold gallium nitride semi-conductor form, Zn, Mg, Be, calcium, Sr, Ba, etc. which are p mold DOPANDO are made to dope. Only by doping p mold dopant, since it is hard to form a gallium nitride semi-conductor into low resistance, it is desirable to make low resistance form by low electron beam irradiation, a plasma exposure, or heat-treating after p mold dopant installation. Then, the contact layer front face of each semi-conductor is exposed by etching so that power can be supplied to pn each semi-conductor. The electrode which supplies power to the contact layer of each conductivity type is made to form with the sputtering method, a vacuum deposition

method, etc. p mold electrode makes the pad electrode (408) which carries out wire bond to the metal thin film as a whole surface electrode (407) of translucency have formed, respectively.
[0030] After it carries out direct full cutting of the formed semi-conductor wafer with the dicing saw which the blade which has the edge of a blade made from a diamond rotates or it cuts the slot of width of face larger than edge-of-a-blade width of face deeply (half cutting), it breaks a semi-conductor wafer according to external force. or the scriber in which the diamond stylus at a tip carries out both-way rectilinear motion -- a scribe line (circles of longitude) very thin to a semi-conductor wafer -- for example, after lengthening in a grid pattern, according to external force, a wafer is broken and it cuts in the shape of a chip from a semi-conductor wafer.
[0031] the case where field use is taken into consideration -- high -- as a brightness semiconductor material -- yellow and green -- It is a nitride system compound semiconductor (it InxGayAlzN(s)) as a semiconductor material which emits light in blue, a bluish green color, etc. However, although it is desirable to use 0<=x, 0<=y, 0<=z, and x+y+z=1 and it is desirable similarly to use aluminum, an indium, a gallium, and a phosphorus system semi-conductor in yellow or red, it cannot be overemphasized that many things can be used by the application.
[0032] The light emitting device usually using the nitride system compound semiconductor as a light emitting device to which the blue, the yellow, or the bluish green color for signals can emit light in high brightness may make the electrode of a positive electrode (408) and a negative electrode (409) form in the same semi-conductor front-face side unlike the light emitting device using ingredients with which red and yellow can emit light, such as AlInGaP of a 4 yuan system. Moreover, it has considered as terrorism structure (403) (405) to the double from which a presentation differs on both sides of a barrier layer (404).
[0033] Although the light emitted from a light emitting device (102) is emitted from the front face of a light emitting device (102), it also has the light emitted to others and double by spreading a barrier layer (404) etc. like a waveguide for terrorism structure etc. Therefore, a part of light emitted from the barrier layer (404) end-face side becomes the shade of the electrode (409) which supplies power to a light emitting device (102). Usually, the metals and alloys with which an electrode (409) shades light, such as W, aluminum, Ti, and In, are used. The light to which the light emitting device was emitted by the shade of this electrode (409) cannot emit light to homogeneity isotropic. Especially, to the light, since a gallium nitride system compound semiconductor has good permeability, it will appear notably.
[0034] On the other hand, the light emitted from light emitting diode makes it condense by the mold member (101) (501), and can give a desired luminescence property. However, the light condensed by the mold member (101) (501) is greatly dependent on the light emitted from the light emitting device (102) (502). In the light emitting diode which made the mold member (101) (501) the specific configuration in order to make the light from a light emitting device (102) (502) emit light in the specific direction especially, the directional characteristics of the light emitted from the cup (410) of the mounting lead (103) (503) with which the light emitting device (102) (502) has been arranged influence more greatly than the directional characteristics by the optical lens. Therefore, if homogeneity light does not emit light isotropic from a light emitting device (102) (502), it is in an inclination difficult to get about the luminescence property as a request.
[0035] This invention arranges a light emitting device (102) (502) in consideration of the configurations of the light emitted with an anisotropy from a light emitting device (102) (502), and a mold member (101) (501). On the curved surface where radius of curvature (false curvature is included) is large and where a lens scale factor is small, it is desirable for there to be much quantity of light from a light emitting device (102) (502), since collecting power is low. On the other hand, since there are few rates which radius of curvature (false curvature is included) contributes to the small curved surface where a lens scale factor is large extending an angle of visibility and an optical-axis top has high collecting power, the quantity of light from a light emitting device (102) (502) is good comparatively at least. It considers as the light emitting diode which can acquire the luminescence property as a request by taking these into consideration. That is, when the light emitted from the luminescence observation side side on an optical axis by supplying power to the light emitting device (102) arranged on a cup (410) is not

emitted to homogeneity, a mold member (101) and a light emitting device (102) are arranged so that a part [light emitting device / (102)] with the darkest luminescence may be arranged at the symmetry to the part and optical axis with the smallest radius of curvature of a mold member (101).
[0036] Moreover, when emitting light isotropic from a light emitting device (502), a dark part may produce a mold member (501), such as becoming the shade of a conductive wire (505), in view of the luminescence observation side side on an optical axis in case there is nothing. It is made to arrange so that it may see to the symmetry from the luminescence observation side side on an optical axis and the darkest part may come to it also in this case to the part and optical axis with the smallest radius of curvature of a mold member (501). By these, it can consider as the light emitting diode which can acquire a desired luminescence property most efficiently.
[0037] (Lead terminals 103, 104, 503, and 504) A lead terminal (103) (104) (503) (504) works as an electrode which supplies power to a light emitting device (102) (502) from the exterior. Therefore, electrical conductivity with a sufficient lead terminal (103) (104) (503) (504) and connectability with a bonding wire etc. are called for. When arranging a light emitting device (102) (502) on a lead terminal (103) (503), it works as a mounting lead etc. and what takes a flow without making a light emitting device (102) (502) load works as an inner lead.
[0038] In this invention, in order to make luminescence from light emitting diode emit light efficiently, it is desirable to arrange the light-emitting part of a light emitting device on the optical axis of the mold member (101) (501) used as an optical lens. In this case, since each radius of curvatures from the tip seen from the luminescence observation side side on an optical axis differ, a lead terminal will incline toward a 1st radius-of-curvature side with small radius of curvature (upper part). When distance with the end face of a lead terminal and a mold member is short, the difference in an expansion coefficient etc. is easy to tend be destroyed. Therefore, the thing to which distance with a mold member (101) (501) end face can earn more the direction of [between a mounting lead and an inner lead] and it is supposed that it is parallel is desirable.
[0039] on the other hand, or the reinforcement of a mold member (101) (501) is high When supple Since it is hard to move in the direction of a direction between lead terminals (between a mounting lead (103) (503) and an inner lead (104) (504)) at the time of installation of a substrate, the direction of [between a mounting lead (103) (503) and an inner lead (104) (504)] It can also be made to arrange in a direction between the 1st radius of curvature (upper part) and the 2nd radius of curvature (lower part). The direction between lead terminals can acquire the luminescence property stabilized from it being hard to incline even if it attaches in a substrate.
[0040] When arranging a light emitting device (102) on a mounting lead (103), thermosetting resin etc. can perform. Specifically, an epoxy resin, silicone resin, acrylic resin, imide resin, etc. are mentioned. Moreover, while pasting up a light emitting device (502) and a mounting lead (503), in order to make it connect electrically, Ag paste, carbon paste, an ITO metallurgy group bump, etc. can be used. Furthermore, a reflex function may be given to a cup front face in order to raise the luminous efficiency of each light emitting device (102) (502).
[0041] As concrete specific resistance used for a lead terminal (103) (104) (503) (504), below 300micro ohm-cm is desirable, and it is below 3micro ohm-cm more preferably. Moreover, it is called for that thermal conductivity of a lead terminal (103) (104) (503) (504) is good in order to miss efficiently generation of heat from a light emitting device outside. As for especially the mounting lead (103) (503) with which a light emitting device (102) (502) is arranged, it is more desirable than other lead terminals (104) (504) to enlarge surface area and to raise heat dissipation nature. the concrete thermal conductivity of a lead terminal (103) (104) (503) (504) -- 0.01cal/ (s) (cm2) (degree C/cm) above -- desirable -- more -- desirable -- They are 0.5cal/ (s) (cm2) (degree C/cm) above. Moreover, as an ingredient which fulfills these conditions, iron, copper, the copper containing iron, the copper containing tin, etc. are mentioned.
[0042] Moreover, in order to connect electrically a light emitting device (102) (502) and a lead terminal (103) (104) (503) (504), an electrical installation member is used. The conductive wire (105) (505) to which the light emitting device (102) (502) and the lead terminal (103) (104) (503) (504) were connected with the metal wire is sufficient as an electrical installation member, and it may be made to

form by the conductive paste metallurgy group bump. What has ohmic nature, mechanical-connections nature, electrical conductivity, and thermal conductivity good [an electrical installation member] is called for. As thermal conductivity of an electrical installation member, 0.01cal/ (s) (cm2) (degree C/cm) above is desirable, and is 0.5cal/ (s) (cm2) (degree C/cm) above more preferably. Specifically, the bonding wire using those alloys, such as gold, copper, platinum, and aluminum, is mentioned. Moreover, the electroconductive glue which filled up conductive fillers, such as silver, carbon, and ITO, with resin can also be used. In consideration of workability, an aluminium wire or a gold streak is desirable. It cannot be overemphasized that it is not hereafter restricted only to this although the example of this invention is explained in full detail.

[0043]

[Example] (Example 1) the silicon-on-sapphire (401) top by which the LED chip which used for the luminous layer the InGaN semi-conductor whose luminescence peak is 500nm as a light emitting device was washed -- TMG (trimethylgallium) gas, TMI (trimethyl in JUUMU) gas, nitrogen gas, and dopant gas -- carrier gas -- a sink and MOCVD -- it was made to form by making a nitride system compound semiconductor form by law The gallium nitride semi-conductor which has n mold conductivity and p mold conductivity is made to form by switching SiH4 and Cp2Mg as dopant gas at the time of membrane formation. The contact layer (403) which is the gallium nitride semi-conductor which has n mold conductivity as a light emitting device, and the cladding layer (405) which is the gallium nitride aluminum semi-conductor which has p mold conductivity and the contact layer (406) which has p mold conductivity were made to form. The barrier layer (404) of the non dope InGaN which is about 3nm in thickness and is made into single quantum well structure between the contact layer (403) which has n mold conductivity, and the cladding layer (405) which has p mold conductivity was formed. (In addition, gallium nitride is made to form at low temperature on silicon on sapphire (401), and it has considered as the buffer layer (402).)

In order to take the electrode of a positive electrode (407) (408) and a negative electrode (409) from the same semi-conductor front-face side, the semi-conductor layer is made to have removed from the p type semiconductor layer side partially to a part of contact layer (403) which is a n-type semiconductor. The electrode (409) of the thickness exceeding the thickness of a barrier layer (404) is formed in the semi-conductor (403) front face used as n mold contact layer which it was removed and was exposed by the sputtering method. On the other hand, the transparent electrode and the pad electrode are made to have formed on p mold contact layer. In this way, after lengthening a scribe line, external force was made to divide the done semi-conductor wafer, and the LED chip with which a bluish green color can emit light as a light emitting device was made to form. When power was supplied to the LED chip, the LED chip with which bluish green colored light can emit light was formed. As a result of investigating the radiation direction of a luminous LED chip, the electrode formed on n mold contact layer shades the light emitted from a barrier layer. It saw from the luminescence observation side side, and luminescence was observed few most darkly in the extended direction of n mold electrode (409) among the light emitted from the barrier layer (404).

[0044] Die bonding of the LED chip (102) was carried out to the mounting lead (103) which has a cup (410) at the tip of the lead terminal (103) (104) of the copper containing iron which carried out silver plating with the epoxy resin. The direction between lead terminals (103) (104) and the direction between electrodes (408) (409) of an LED chip (102) arrange arrangement of the LED chip (102) prepared in the mounting lead (103) to the abbreviation perpendicular. Wire bonding of each electrode (408) (409) of an LED chip (102), a mounting lead (103), and the inner lead (104) was carried out by the gold streak (105) whose diameter is 30 micrometers, respectively, and the electric flow was taken.

[0045] The crevice in which the magnitude of the 1st radius of curvature (upper part), the 3rd and 4th radius of curvature (longitudinal direction), and the 2nd radius of curvature (lower part) can, on the other hand, form the convex translucency mold member (101) which fills the relation of the magnitude of the magnitude < 2nd radius of curvature of the magnitude = 4th radius of curvature of the magnitude < 3rd radius of curvature of the 1st radius of curvature as metal mold of a mold member (101) is made to form.

[0046] The lead terminal (103) (104) with which the LED chip (102) has been arranged has been arranged so that n mold electrode (409) which shades the light from a barrier layer (404), and a curved surface with the 2nd radius of curvature may approach most into a crevice, and the epoxy resin was poured in. The epoxy resin was stiffened in 140-degree-C 5 hours. The tip (201) of the formed mold member (101) is arranged on the optical axis of an LED chip (102).
[0047] The magnitude of the 1st radius of curvature from the tip (201) which constitutes a cross section including the optical axis with which the formed light emitting diode passes along the tip (201) of a translucency mold member (101) to an edge (202) is about 3, and the magnitude of the 2nd radius of curvature from a tip (201) to the other-end section (203) is about 3.75. Moreover, the magnitude of the 3rd radius of curvature from the tip (201) which constitutes said cross section and a cross section including the optical axis which makes a perpendicular to an edge (204), and the 4th radius of curvature from a tip (201) to the other-end section (205) has set to about 3.5, respectively. Moreover, the field where the radius of curvature of a mold member (101) is small is arranged in the direction where the light which arrangement of an LED chip (102) and a mold member (101) was emitted from the LED chip (101), and was reflected from the cup (410) is the darkest.
[0048] Power was supplied to the formed light emitting diode, and the orientation characteristic direction on either side and the up-and-down orientation property were investigated. The place where luminescence reinforcement is the highest is made into 100%, and relative luminescence reinforcement is shown in drawing 6 . It has checked that an above light could consider as high brightness light emitting diode with a large angle of visibility few right and left and down.
[0049] (Example 2) The magnitude (minor axis of an ellipse) of the 1st radius of curvature from the tip (201) which constitutes a cross section including the optical axis passing through the tip (201) of a translucency mold member (101) to an edge (202) is about 3.2, and sets a major axis to about 4.1. The magnitude (minor axis of an ellipse) of the 2nd radius of curvature from a tip (201) to the other-end section (203) is about 3.6, and a major axis sets to about 4.55. Moreover, the magnitude of the 3rd radius of curvature (minor axis of an ellipse) from the tip (201) which constitutes said cross section and a cross section including the optical axis which makes a perpendicular to an edge (204), and the 4th radius of curvature (minor axis of an ellipse) from a tip (201) to the other-end section (205) sets to about 3.5, respectively. Moreover, light emitting diode was made to form like an example 1 except having considered as the aspheric surface expressed with the ellipse which set the major axis of this ellipse to 4.35.
[0050] The mold configuration of the formed light emitting diode The 1st lens scale factor including from the tip which constitutes the cross section of a translucency mold member including the optical axis passing through a tip to an edge, The 4th lens scale factor containing the 2nd lens scale factor containing from a tip to the other-end section, the 3rd lens scale factor including from the tip which constitutes said cross section including an optical axis and the cross section which makes a perpendicular to an edge, and from a tip to the other-end section, respectively the 2nd lens scale factor -- < -- lens scale-factor [of ** a 3rd] = -- the 4th lens scale factor -- < -- the relation of the 1st lens scale factor is filled. In addition, if the formed light emitting diode is observed from a luminescence observation side side, while constituting the curve in which the mold member carried out periphery continuation, the curved surface of a lower part including the 2nd, 3rd, and 4th radius of curvatures constitutes the semicircle to an upper curved surface including the 1st, 3rd, and 4th radius of curvatures constituting an ellipse. Moreover, an ellipse is owner ****** about a minor axis smaller than the radius of a semicircle.
[0051] In this way, the luminescence property of the formed light emitting diode can be made it is large to right and left and down, and upward narrow like an example 1. It is made to arrange to 300 substrates so that the directional characteristics of the formed light emitting diode may be arranged, respectively, it may see from a luminescence observation side side and it may become circle-like. It is made to solder so that the circuit pattern and each light emitting diode which were formed in the substrate can be turned on. While arranging this to a resin case, the case of translucency is prepared in the front face of a resin case. In addition, the afternoon sun cure panel for absorbing the light from outpatient department light

between light emitting diodes, and raising a contrast ratio is arranged. The afternoon sun cure panel is made to have carried out hair transplantation processing of the resin fiber colored the black of a dark color system. An LED unit is constituted by fixing, while arranging the substrate and afternoon sun cure panel by which light emitting diode has been arranged in a resin case and the case of translucency, and closing by packing.

[0052] In this way, the signal was made to form by containing the formed LED unit to **** of aluminum. Transverse-plane altitude can consider as a signal with much quantity of light highly right and left and down, controlling the quantity of light upward by supplying power to each light emitting diode of a signal.

[0053] (Example 3) While considering as the light emitting device which lessens the presentation of In which constitutes an LED chip and consists of a nitride semi-conductor with which blue can emit light, light emitting diode was made to constitute like an example 1 except having arranged the epoxy resin which Y0.8Gd0.2aluminum5O12:Ce contained as an yttrium aluminum garnet system fluorescent substance activated with the cerium on the LED chip in the cup of a mounting lead. Almost like the example 1, the main luminous intensity of the formed light emitting diode was high, and it was able to constitute right and left and light emitting diode with a down large half power angle. Moreover, with the blue glow from an LED chip, the yellow light from a fluorescent substance emitted light, and white was observed.

[0054]

[Effect of the Invention] This invention is a thing which reduces the unnecessary upper quantity of light and which is used as the high brightness light emitting diode which can emit light on a wide-field-of-view square in a longitudinal direction and down on the other hand by making a mold member into a specific configuration. Moreover, the effect of reflective from outpatient department light can consider as the light emitting diode which was excellent in signals few.

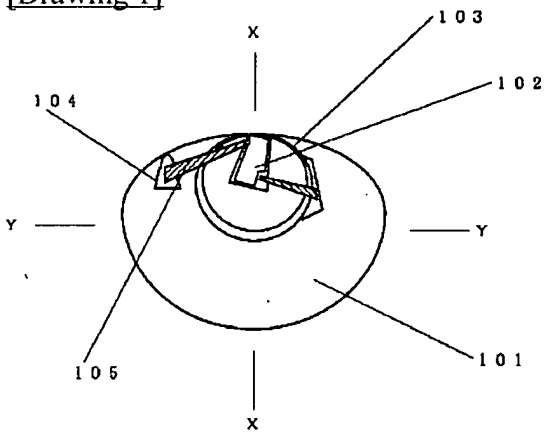
[Translation done.]

* NOTICES *

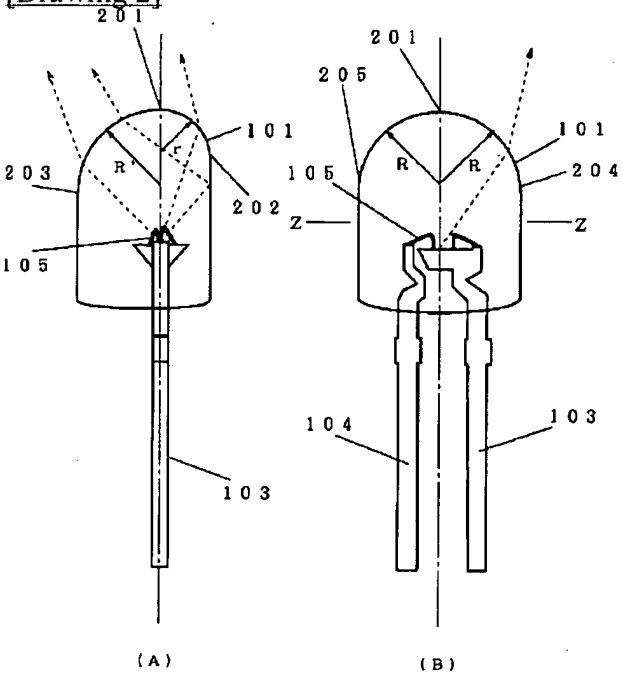
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

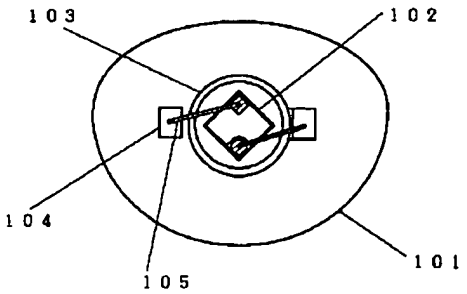
[Drawing 1]



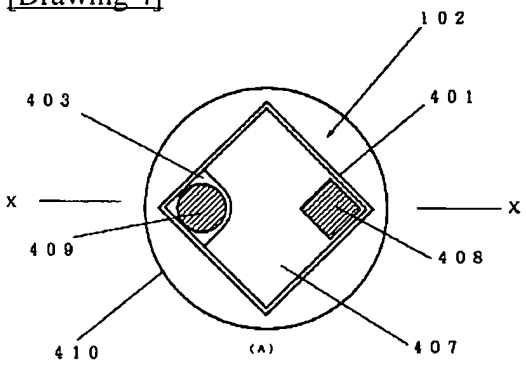
[Drawing 2]

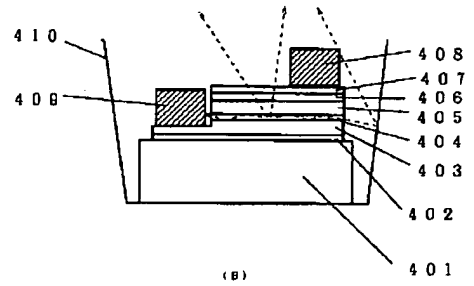


[Drawing 3]

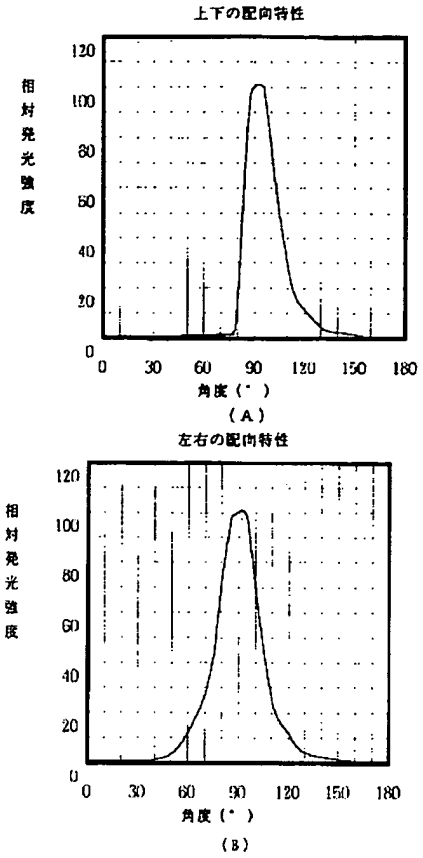


[Drawing 4]

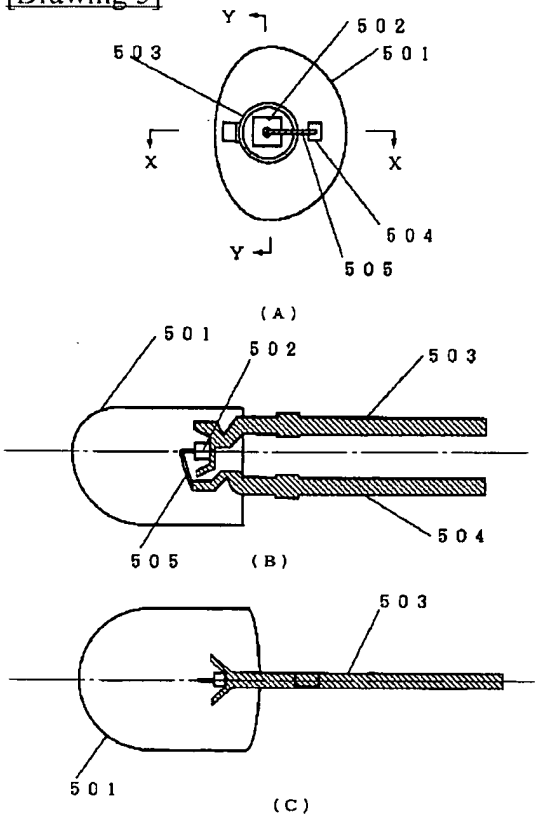




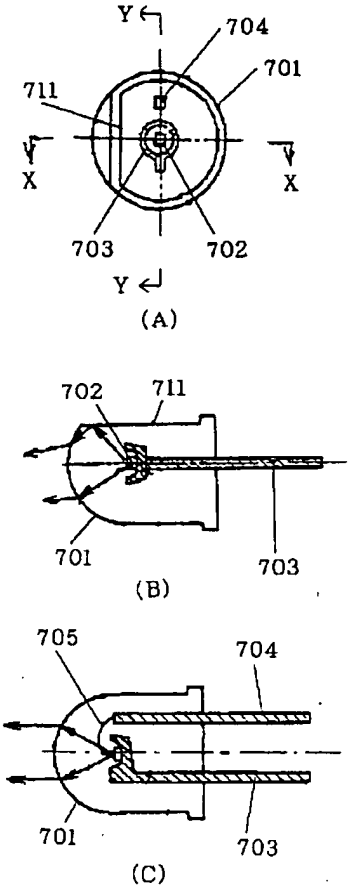
[Drawing 6]



[Drawing 5]



[Drawing 7]



[Translation done.]